

THE ETHNOBOTANY AND MEDICINAL PROPERTIES OF RHODIOLA (*RHODIOLA ROSEA*)

IN LABRADOR AND POTENTIAL
APPLICATIONS IN COMMUNITY-BASED
NUTRACEUTICAL MARKETING ENTERPRISES

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1. Acknowledgements

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2. Executive Summary

Recent ethnobotanical studies in Arctic and Sub-Arctic communities have indicated a resurgence of interest in the traditional use of plants as medicine, as well as in their potential as economic products (Berkes and Davidson-Hunt 2007). However, scientific research on the medicinal potential of plants native to Labrador is virtually nonexistent. This project investigated the biology as well as the medicinal and economic potential of rhodiola (*Rhodiola rosea*), an arctic medicinal plant native to coastal ecosystems of Labrador, for the development of a sustainable local enterprise with benefits for participating Nunatsiavut Inuit communities. Both field and lab studies were used to determine the best cultivators for future cultivation. A Business Opportunity Analysis for potential community-based enterprise in Nunatsiavut was written and submitted to the Nunatsiavut Government (NG) in May 2014 [document attached in Appendix 2]. Discussions with the NG Economic Development Department representatives and a MUN Business professor are underway to determine if the NG is interested in moving forward with this potential project.

3. Introduction

3.1 Project Background

Rhodiola (*Rhodiola rosea*) is valuable in both traditional healing modalities and the natural products industry, due to the medicinal constituents found in its roots and rhizome. However, global commercial demand is almost exclusively fulfilled by wild-harvested Eurasian rhodiola rhizomes, leading to overharvest in those areas. The only rhodiola cultivated in North America is of Russian origin, grown by way of a grower's cooperative, the Alberta Rhodiola Rosea Growers Organization (ARRGO). Cultivating a North American source of rhodiola in Labrador would create an opportunity for a sustainable, aboriginal, community-based enterprise to produce a northern, fair trade natural health product. Strong support from Nunatsiavut Inuit Elders and community prompted research to investigate Labrador rhodiola as a natural health product, for the development of a local enterprise with benefits for participating communities.

The goal of the enterprise is to establish a community-based business involving the sustainable cultivation and processing of rhodiola for market, collaboratively implemented by the Nunatsiavut Government with input from the local community, in consultation with a team of advisors from Memorial University and Montreal Botanical Gardens. This enterprise would provide technical training and employment for approximately 2-4 Nunatsiavut community members or more, while also creating a sustainable economy based upon a locally sourced plant, with full consideration for due diligence and the intellectual property of Inuit Elders. Such a sustainable approach would ensure that the plant would not be overharvested, causing local extirpation.

3.2 Rationale

Ethnobotanical interviews conducted in Northern Labrador have indicated that there is significant traditional knowledge of medicinal uses of *Rhodiola rosea* (Cuerrier et al. 2012). *Rhodiola* is used medicinally to treat a wide range of complaints including fatigue, depression, and low immunity (Brown 2002), and it has become increasingly significant in the commercial market on a global scale. However, with the exception of the Russian *rhodiola* grown in Alberta through ARGO, the market demand for *rhodiola* is almost exclusively met by wild-harvested rhizomes of Asian and European origins, placing considerable pressures on wild populations, while also creating a significant potential for cultivation enterprises (Ampong-Nyarko 2010; Cuerrier & Ampong-Nyarko 2014; for more background see Opportunity Analysis, Appendix 2).

The harvest pressure on wild *rhodiola* populations as a result of meeting commercial demand, combined with the stressful effects of climate change (Cavalier 2009), amplifies the need to establish sustainable alternative sources for *rhodiola* harvest in order to satisfy market demand. There are many examples of how medicinal plants, many of which are also key cultural species, have been driven almost to extinction by unregulated overharvest and are now on the endangered list globally. Many times it is not the local community who benefits from this overharvest. By taking appropriate varieties of Labrador *rhodiola* into cultivation, this will ensure locally sustainable development and production of the plants, while also ensuring that the active medicinal chemicals are consistent and of the highest quality. Results obtained from the collection of data on the ethnobotany, basic biology, and phytochemical analysis of *rhodiola* in Labrador establish a foundation for a business venture centered on the cultivation of this economically valuable medicinal plant, to ensure sustainable growth and development in future planning.

Market data show a trend of consistent growth over the last decade in the natural products industry, and annual growth is predicted to continue, indicating robust economic potential in developing a natural health product (Lindstrom et al. 2014). *Rhodiola* from Labrador would occupy a unique market niche as a sustainable, fair-trade product, based upon local Inuit traditional knowledge, in contrast to most *rhodiola* on the commercial market which is wild-harvested in Eurasia. An enterprise based upon traditional knowledge and local resources presents the potential for a variety of tangible and intangible benefits to participating communities, including job creation, technical training, youth participation, and economic gain with respect for customary practices. However, we know very little about how Inuit perceive the use of their traditional knowledge within a commercial venture (Cuerrier et al. 2012, Hindle and Lansdowne 2007). This project could contribute to the conservation and management strategies of valuable natural resources, as well as the economic strength and self-reliance of Labrador communities. By partnering with indigenous communities in the creation of entrepreneurship, this will stimulate the development of an enterprise culture that respects and integrates cultural traditions and lead to the empowerment of communities as economic agents (Hindle and Lansdowne 2007), and ensures a sustainable source for marketing this product into the future.

3.3 Objectives

1. Collect ethnobotanical data in Labrador communities (Nain and Rigolet) through focus groups and semi-structured interviews to inform sound collaborative development of a community-based enterprise
2. Gather data on the growth and habitat of wild populations of rhodiola in coastal ecosystems of Labrador to guide selection of appropriate cultivars
3. Conduct phytochemical analysis to determine the effects of environmental conditions (latitude and growth substrate) on medicinal potency of rhodiola grown in Labrador
4. Conduct preliminary field trials near several participating communities to assess the optimal local cultivars and growing conditions for cultivation of rhodiola
5. Facilitate the planning of a future community-based enterprise that is:
 - a) culturally appropriate
 - b) ecologically sustainable
 - c) economically viable

3.4 Research Methodology and Approach

Research questions/Scope of Research:

1. What is the extent of the traditional knowledge of medicinal plants and specifically of rhodiola held by Inuit Elders in Labrador?

Ethnobotanical data were gathered in Nunatsiavut communities (Nain and Rigolet) through focus groups and semi-structured interviews. Semi-structured interviews were conducted in Rigolet utilizing locally harvested plant specimens to stimulate discussion about medicinal plant knowledge in the community, and a focus group was conducted with Inuit Elders in Nain.

2. How do Inuit community members envision applying knowledge of rhodiola's medicinal attributes to implement a community-based enterprise?

Consultation with community partners is integral to structuring a research framework with applied benefits (Hindle and Lansdowne 2007), and is key goal of ArcticNet. Building upon previous interview results, a focus group was facilitated with Nunatsiavut Inuit Elders in Nain. The purpose of this session was to further explore specialized knowledge of rhodiola and other medicinal plants, and to inform sound collaborative development of a future community-based enterprise by assessing community goals for a nutraceutical enterprise. An open house was also hosted in Rigolet as an informational session and to invite community participation.

3. How do the populations of rhodiola along the coast of Labrador vary in growth and production of seed, rhizomes, and bioactive compounds, and how does this inform the selection of the most appropriate variety for commercial cultivation and medicinal potency?

Data investigating the basic biology of wild Nunatsiavut rhodiola populations were gathered from coastal sites on islands outside Nain and Rigolet along a latitudinal

gradient. Basic growth measurements (size, height, basal diameter) and reproductive data (sex, flowers, seed productivity, number of ramets) were taken. We also gathered seed for subsequent horticultural trials.

A subset of the plants measured for growth was harvested to measure rhizome biomass production in relation to plant size and reproductive states. These rhizomes were then either analyzed for medicinal constituents (Filion et al. 2008) or propagated in community garden trials. Phytochemical analysis was conducted through collaboration with our research partner, Dr. John T. Arnason at the University of Ottawa, in order to determine the effects of environmental conditions (latitude and growth substrate) on medicinal potency of wild rhodiola grown in Nunatsiavut. Phytochemical analysis assessed the presence and levels of target medicinal compounds (tyrosol, salidroside, rosinarin, rosinavin, and rosin).

4. What horticultural methods are best employed for cultivation of rhodiola in coastal habitats of Labrador, specifically in the Nain and Rigolet areas?

Preliminary field trials were conducted near target communities (Nain and Rigolet) to determine the local cultivars and growing conditions for cultivation of rhodiola that would optimize productivity and potency of medicinal components. Propagation trials were also conducted in collaboration with MUN Botanical Gardens, using a large above-ground bed to monitor growth and survival of rhodiola specimens propagated from root division of samples collected in Labrador. Funding and time constraints limited the extent of our field trial investigations; hence further trials should be carried out in additional sites once communities have signaled their interest.

3.5 Clearances

Ethics clearance from MUN's Interdisciplinary Committee on Ethics in Human Research (ICEHR) was maintained throughout the course of this research (ICEHR Number: 20130328-SC).

4. Project details and results

Results:

Growth

To inform cultivar selections, data were collected to determine if there are differences in growth and reproduction in rhodiola among growth substrate types and locations in coastal Labrador. From Nain and Rigolet, 75 samples of rhodiola were collected in July-August 2012; 12 additional samples were collected in August 2013 to increase sample size where 2012 samples showed high levels of variability. Measurements were taken of rhodiola growth and reproductive productivity across substrate types and along a latitudinal gradient between Nain to Rigolet. Results showed that rhizome biomass was much greater in southern populations, particularly in sandy and organic substrates.

The following growth trends were observed:

- **Latitude** has a significant effect upon rhizome biomass; southerly locations (Rigolet) had greater biomass than northerly populations (Nain)
- **Growth substrate** has a significant effect upon rhizome biomass after accounting for latitude; specimens gathered from **sandy** and **organic** substrates had greater biomass than those growing in **rocky** substrates
- Differences in growth and biomass between male and female plants was not significant
- Root weevil (*Dryocoetes krivolutzkajae*) was observed in rhodiola rhizomes, the first record of its incidence in North America. It did not have a significant effect upon growth.

Phytochemistry

The above rhodiola samples were also analyzed to assess the content of active medicinal constituents in the rhizome using UPLC-MS analysis, to determine the effects of latitude, growth substrate, and sex upon potency.

Phytochemical analysis showed:

- **Labrador rhodiola possesses key phytochemical constituents** known for medicinal potency (tyrosol, salidroside, rosin, rosin, and rosin)
- **Substrate** has a significant effect on phytochemistry; less tyrosol and salidroside in rocky substrates, less rosin and rosin in sandy soil
- Sex did not have a significant effect upon phytochemistry
- Weevil infestation did not have a significant effect on phytochemistry

Horticultural trials

Rhodiola specimens gathered sustainably from wild Labrador populations were propagated using a root division technique and planted at two field sites (Nain and Rigolet) and MUN Botanical Garden in August 2012 (107 plants total). Trial plots were monitored in Aug 2013 and 2014. The survival of the MUNBG plants and those grown in the Nain common garden was very high in 2013, over 95%; however that year the Rigolet garden had been completely destroyed by an animal, probably a fox. We relocated the Rigolet trial garden closer to town in August 2013 and replanted with 22 new plants harvested from the surrounding area. In 2014 the survival rates of rhodiola planted in the Nain trial gardens had decreased, likely as a result of poor drainage and/or excess organic matter at the site. The Rigolet trial gardens in 2014 showed moderate survival rates; both gardens will need to be followed for several years to evaluate survival and growth. Further trials will be necessary to fully assess appropriate conditions for cultivation of rhodiola in Labrador as previous research on propagation in North America was conducted in Alberta, which has a different growing environment. Additionally, the plant takes a number of years to reach harvestable maturity (depending on the propagation technique used), and the current research was time-limited.

Traditional knowledge & Community perspectives

To investigate attitudes towards integrating traditional knowledge with commercial enterprises in the community and ensure due diligence in consulting and developing partnership with the Nunatsiavut community, we held a round table discussion with Inuit Elders in Nain (August 13, 2013) with 13 Elders in attendance. It was a wide ranging discussion on how Inuit used/use rhodiola medicinally and for food. Several previously undocumented traditional Inuit uses of rhodiola as medicine were shared. The Elders in Nain were surprised to learn of rhodiola's international commercial value. We also discussed the possibility of starting a community-based enterprise and what that might entail, inviting open discussion about any concerns they might have including commercial application of traditional knowledge. Elders expressed strong support for a community-based herbal products enterprise, saying, "*Just get on with it!*"

We also conducted semi-structured interviews regarding the traditional use of rhodiola and other local botanicals, using a collection of local plants to elicit discussion with 4 Elders/settlers in Rigolet in August 2013, leading as well to broader discussions on conservation and culture. At a community open-house at the town hall, a discussion took place informing two members of the municipality (including Mayor Charlotte Wolfrey) about the possibility of a cottage industry based on rhodiola.

Community-based enterprise development

Since the Nain roundtable was unanimously in favour of starting a business enterprise based on rhodiola, and the (former) mayor of Rigolet is also solidly behind this enterprise, a business opportunity analysis was conducted to assess the prospects for community-based enterprise. This document was informed by the Entrepreneurship Training Program (ETP) at MUN completed in March 2013 and refined through consultations with the Genesis Centre for Business Incubation at MUN. This business opportunity analysis was then presented to Mr. Tom Sheldon, Director of the Environment (Nunatsiavut Government) in May 2014. He then brought this to the NG executive for review, and to determine if the NG will support this effort. Additional partnerships with Enactus Memorial (formerly SIFE), initiated through conversations with Lynn Morrissey, the Enactus Memorial Faculty Advisor, may help with business implementation in Nunatsiavut, particularly as there is potential for social and environmental impact.

Continuing partnerships with the MUN "rhodiola team", Enactus Memorial and representatives of the Nunatsiavut government (Director of Economic Development, Francine Couture and Environmental Assessment Manager, Andrea Hoyt) are moving ahead. We will seek additional funding sources available through the Enactus group (spearheaded by Prof. Morrissey), which will enable further research and community engagement initiatives aimed at bringing this project to fruition. These potential funding applications align with the Nunatsiavut Government's economic development targets.

Summary of business opportunity analysis (see Appendix 2 for full document)

Product Option(s)

- 1) Raw material
- 2) Tea blend
- 3) Liquid extract
- 4) Capsules

Target Consumers

- 1) Visitors of local Nunatsiavut craft shops (retail sale)
- 2) Retailers of natural health supplements (for wholesale)
- 3) Supplement manufacturers and grower's co-operatives (for wholesale of bulk material)

Operational logistics

- 1) Agricultural production - develop appropriate cultivation protocol for Labrador with attention to Good Agricultural Collection Practices (GACP)
- 2) Post-harvest processing - within the community, in cooperation between local communities, or through external partnerships
- 3) Manufacturing - within Labrador or through external partnerships, with adherence to Current Good Manufacturing Practice (CGMP)

5. Recommendations and future directions

Although we have made important inroads into the potential for rhodiola cultivation, further research needs to be done towards the development of appropriate horticultural methods for growing rhodiola in Labrador, as this is the first attempt at cultivating this native species, in environments very different than those in Alberta (Ampong-Nyarko 2010). Field trials should be expanded to include more sites around Nunatsiavut communities that are interested in growing the crop. Research funds should be sought to continue this work. The Business Opportunity Analysis, pending decisions by the community and the NG, should be refined into a specific business plan, leading to a self-sustaining, community-based enterprise in Labrador. A community engagement tour in Nunatsiavut communities could help to align priorities within the province and determine which communities would like to be involved should the project move forward. Technical training for several Nunatsiavut youth in skills specific to rhodiola cultivation and processing will build community capacity in applied horticulture and business.

6. Conclusion

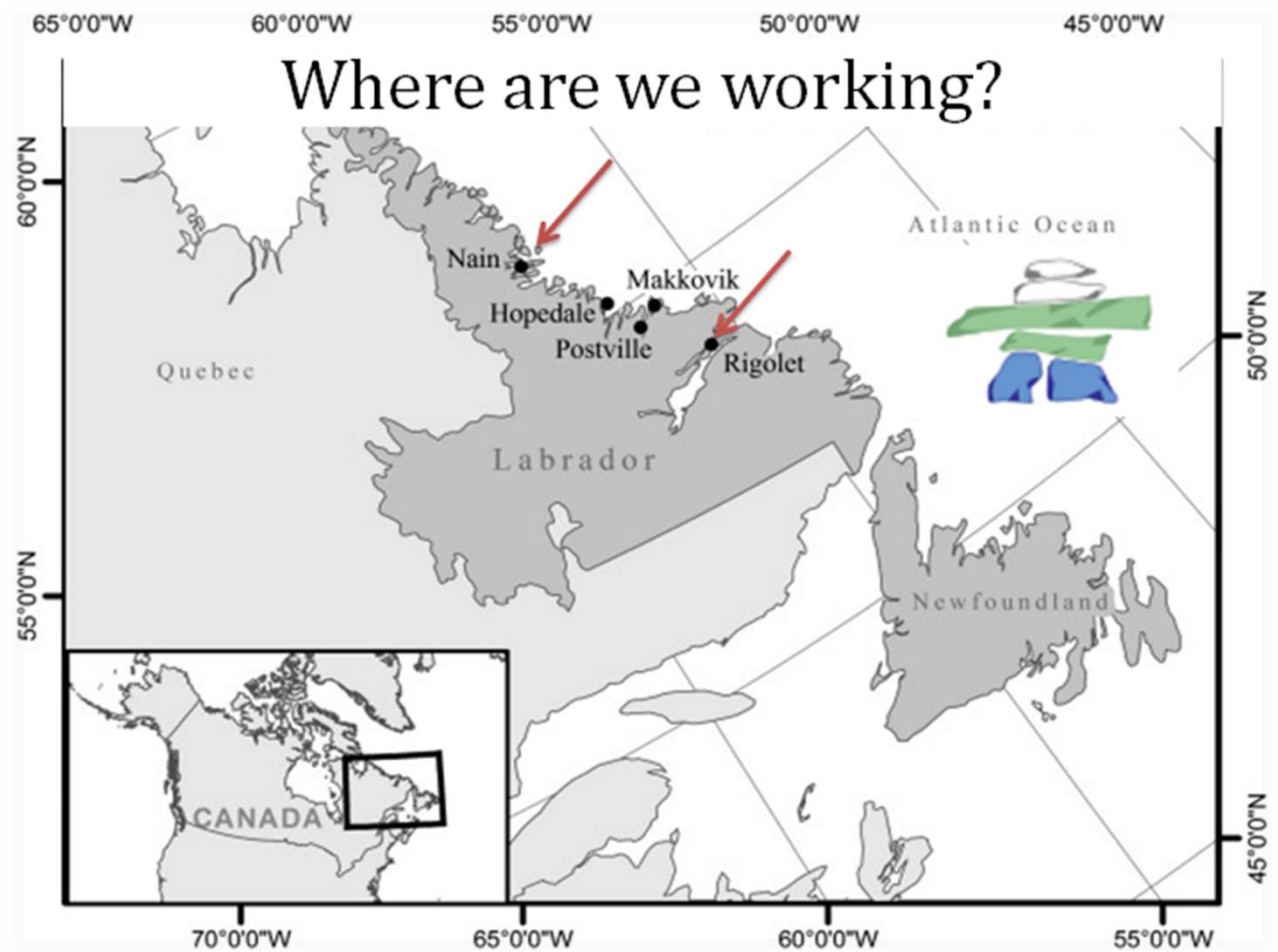
Our research confirms that Labrador rhodiola shows potential as a natural health product for a sustainable community enterprise with tangible and intangible benefits for Nunatsiavut Inuit communities. Round table consultations with Nunatsiavut Inuit Elders have established a foundation for the development of an herbal products enterprise with due diligence and community ownership. Based on these roundtable discussions, the enterprise has full community support. Biological assessments of wild Labrador rhodiola have informed cultivar selection for sustainable cultivation, indicating that Labrador rhodiola does indeed possess known medicinal constituents, and that specimens from more southerly latitudes grown in sandy substrates will be the best candidates for cultivation enterprises, yielding greater biomass and potency.

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8. Appendices

8.1 Map of field sites



Map source: Willox et. al. 2012.

Nunatsiavut Roseroot

Opportunity Analysis for a
Sustainable Community Enterprise



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Executive Summary

The goal of this proposed enterprise is to establish a community-based business involving the sustainable cultivation and processing of rhodiola, a local medicinal plant, for market. This business will be collaboratively designed and implemented by the Nunatsiavut Government (NG) with input from the local community, in consultation with a team of advisors from Memorial University and Montreal Botanical Gardens. This enterprise will provide technical training and employment for approximately 2-4 community members or more, while also creating a sustainable economy based upon a locally sourced plant, with full consideration for due diligence and the intellectual property of Inuit Elders.

The following document represents an opportunity analysis, highlighting various business options to provide an overview of the considerations involved in the development of a successful medicinal plant commercialization project. Pending decisions by the NG regarding the project budget, scale of operations, and organizational structure, it is anticipated that a more detailed product roadmap will be devised if/when the NG decides to move ahead with this project. This project will be referred to herein as "Nunatsiavut Roseroot", until the NG decides what they would like to call the project or product.

Description of Business

Despite general economic downturns, the natural products industry has seen consistently robust growth in the last decade. Herbal supplement sales have seen steady growth for nine consecutive years, and in 2012, sales increased by 5.5% from the previous year¹. Consumer awareness of the ill effects of stress is leading to increased interest in stress-modulating, or **adaptogenic** herbs such as rhodiola root. More than forty years of research on adaptogens and rhodiola in particular has brought its benefits to the awareness of the consumer, who seeks better health through natural supplements.² This, combined with the growing market for sustainably sourced fair-trade botanicals, and the lack of such sources for rhodiola in the market, give the enterprise proposed herein a distinct competitive edge. Therefore it is proposed that a **fair trade, sustainably grown** and **potency assured** medicinal plant product such as Nunatsiavut Roseroot shows significant market potential.

Product Description/Option(s)

Tulligunnak, as it is known in Inuktitut, is known scientifically as *Rhodiola rosea*. It is also sometimes called "roseroot", in reference to the fragrance of the root. In the natural health industry, roseroot is usually referred to simply as "rhodiola". Rhodiola is an herb which is traditionally valued by Inuit Elders for its healing properties, and it is also valuable in global commercial trade.

Nunatsiavut Roseroot will be unique to the market for several reasons. Most rhodiola in the commercial supply chain is sourced from Eurasia, and as such this enterprise would provide a North American source, potentially shortening the supply chain and thereby increasing profits, as well as confidence in source quality. The only other commercial North American source is the Alberta Rhodiola Rosea Growers Organization (ARRGO), which produces rhodiola root derived solely from Eurasian genestock rather than the native North American gene pool (Ampong-Nyarko 2014, pers comm). To evaluate and compare the activity of Nunatsiavut rhodiola plants to commercially available stock, biological and phytochemical analyses have been conducted to identify environmental variables that affect rhodiola's potency and growth in Nunatsiavut populations. This will allow for the selection of the most appropriate plantstock and optimize growing conditions (Mardones, PhD research) for potential cultivation across Nunatsiavut.

Nunatsiavut Roseroot will also be unique as the only known "fair trade" rhodiola produced by way of an Aboriginal community enterprise. Round-table discussions which have been conducted with Inuit Elders, as well as a collaborative approach to business development, helps to ensure a business that will bring benefits to Nunatsiavut, both in employment and revenue. Fair trade products occupy a specialized market niche that educated consumers are often willing to pay a premium price for.

Rhodiola root has an established niche in the natural products channel, with a bottle of 30 capsules retailing for approximately \$15-45, depending upon the potency, brand, and retail outlet. The types of products that may be created from rhodiola include herbal teas, liquid extracts, and capsules, and these products could be manufactured in Nunatsiavut as well as in conjunction with contract manufacturers.

As rhodiola leaves are used traditionally by Inuit, the NG might wish to develop this use as a unique product in the market. The leaves of the rhodiola plant are not common in commercial trade, since they do not have all the same medicinal compounds that the roots are known for (i.e. rosavins), although they do contain salidroside, a bioactive compound found in the root as well as several other medicinal plant species. Since the leaves would otherwise be a byproduct of the root harvest, it would not require significant additional processing time or special equipment to harvest and dry the leaves for use in teas, etc. However, commercialization of the leaves may require separate NHP (Natural Health Product; *note that underlined phrases throughout this document are hyperlinked for more information*) approval with Health Canada (demonstration of use, and possibly a separate NPN / Natural Product Number), because the existing Health Canada monograph discusses only the root and rhizome (see Appendix 1). Topical applications made from the leaves, such as creams or salves, would be significantly more complicated than teas to produce, both in terms of equipment and product stability.

The type(s) of product selected for this enterprise will depend upon the desired market/target consumers, as well as the amount of post-harvest processing deemed both

culturally appropriate and economical from a cost-benefit standpoint. Four options are presented for comparison:

1) Raw material sold in bulk or supplied to contract manufacturer

This is the simplest option from a production standpoint. This would require that the rhodiola cultivated in Nunatsiavut be minimally processed onsite post-harvest. Mature roots would require washing, course chopping, and drying. These raw materials are then transferred to a contract manufacturer for further processing (i.e. liquid or supercritical extraction or powdering and encapsulation) or sold in bulk to a growers cooperative (for example [Frontier Co-op](#)) for distribution through established channels. Wholesale distribution has the advantage of minimizing marketing expenditures as well as production costs, but may result in lower profits than sale of value-added products. Raw materials are typically accompanied by a technical dossier which consists of a certificate of analysis and raw material specifications. Health Canada has published the Quality of Natural Health Products Guide to offer guidance on production of natural health products (see [Appendix 2](#)).

2) Tea blend

This option is also fairly simple from a production standpoint, requiring similar post-harvest processing (washing, chopping, drying) followed by sifting and possibly blending with other local ingredients (i.e. Labrador tea, dried berries, etc.), before being packaged as a loose tea or bagged tea. A tea blend has several advantages. It requires little in the way of equipment, and at the same time adds value to the raw material. From a marketing standpoint, this type of product is familiar to the consumer (i.e., [Algonquin Tea](#) or [Northern Delights](#) tea). A box or tin of local medicinal tea might be an appealing product for visitors to purchase at the craft stores, for their own use as well as for gifts. The disadvantage might be a somewhat limited shelf life, depending on packaging.

3) Liquid extract

Also known as tinctures (alcohol-based extracts) or glycerites (alcohol-free extracts), liquid extracts are an efficient means of capturing and delivering the active constituents of medicinal plants. This process would require the cut and dried rhodiola root to be macerated or extracted in either an alcohol (ethanol) or glycerine solvent for a period of approximately one month. Alcohol-based extracts are high potency and have the additional advantage of having a fairly long shelf life. Glycerites are advantageous for avoiding the use of alcohol but are slightly lower potency and have a significantly shorter shelf-life due to the risk of mould contamination.

Many liquid extracts are delivered to the consumer via a dropper bottle. While being a fast-acting means of taking herbal medicines, this has the disadvantage of being a slightly less familiar mode of administration to the mainstream consumer, and would be targeted to a more sophisticated user of nutraceuticals. Liquid extracts may also be encapsulated but this does add a significant processing step. Spray administrations are trending as a novel

means of administering liquid extracts (i.e., [Urban Moonshine Energy Tonic](#)). “Power shots” are also trending in the natural products industry; single serving energy boost drinks that often combine herbal extracts with other vitamins, etc. (i.e., [Gaia Herbal Energy Plus Stress Response](#)).

4) Capsules

Capsules have the advantage from a marketing standpoint of being a more familiar, mainstream mode of supplementation than tinctures or teas. However from a manufacturing standpoint, they require more equipment and handling than liquid extracts or teas. The manufacture of capsules could be done using contract manufacturers, by supplying them with bulk cut and dried plant material. This material is then powdered and sifted under humidity controlled conditions before being encapsulated using automated equipment. Excipients or additives (i.e., rice bran, maltodextrin) may be added as needed to the powdered rhodiola root for ease of production and product consistency and stability. Alternately, contract manufacturers may use extraction processes (hydroethanolic or supercritical) prior to encapsulation for a higher potency product. Encapsulation can also be done by hand with a small device that aligns empty capsules for manual filling and capping of 24-50 capsules per operator (takes about 2 minutes).

Summary of product options

The following table outlines the inputs required for the product options discussed above:

| Product type or output | Materials needed | Equipment needed | Processing required and estimated labor time | Facilities | Costs | Distribution and pricing |
|------------------------|---|---|--|--|--|---|
| Raw material | <ul style="list-style-type: none"> Rhodiola, cut, dried, and sifted | <ul style="list-style-type: none"> Washing equipment Driers, either commercial or homemade Sifters Scales | Roots must be dug, coarsely chopped, washed, further chopped, and dried. Raw material is then packaged in bulk for transfer to contract manufacturer or distributor. | <ul style="list-style-type: none"> Counter space for chopping roots Adequate space and conditions for drying | Root crop washer: \$2,550-2,950 Grindstone Farm barrel washer Commercial dryer: \$15,000 (used)-30,000 (new) and/or Locally constructed dryer: \$500-5,000 | 16 oz (454 g) of powdered, conventional rhodiola retails for approximately \$25; fair trade material could retail higher. |
| Tea/ Blend | <ul style="list-style-type: none"> Rhodiola, cut, dried, and sifted Option to blend | <ul style="list-style-type: none"> Washing equipment Driers, either commercial | Roots must be dug, coarsely chopped, washed, further chopped, dried, and sifted. This | <ul style="list-style-type: none"> Counter space for chopping roots and blending | Root washer and dryer (see above) | Retail approx. \$7-8.95/20 tea bags (Following |

| | | | | | | |
|-----------------------|--|--|--|---|---|---|
| | <ul style="list-style-type: none"> other dried herbs and berries (lab tea, etc.) Cellulose bags Tins or boxes | <ul style="list-style-type: none"> or homemade Sifters Scales Scoops/funnels | then may be blended with other locally sourced flavor ingredients before being packaged loose for retail sale or measured into cellulose individual serving bags and packed for retail sale. | <ul style="list-style-type: none"> Adequate space and conditions for drying | | pricing of Algonquin and Inuit teas) |
| Liquid Extract | <ul style="list-style-type: none"> Rhodiola, chopped and dried (can be fresh if ethanol is used as solvent) Solvent (glycerine and/or ethanol) Glass dropper bottles or glass spray bottles | <ul style="list-style-type: none"> Washing equipment Driers, either commercial or homemade Food-grade carboys for maceration Tincture press Funnels | Roots must be dug, coarsely chopped, washed, further chopped, and most likely dried. This material is then macerated or steeped in solvent for 2-4 weeks before being strained, pressed, bottled, sealed, and labelled. | <ul style="list-style-type: none"> Counter space for chopping roots and blending Adequate space for drying Secure space for extraction | <ul style="list-style-type: none"> Root washer and dryer (see above) Tincture press, 1/2 gallon stainless steel: 780 USD Horizon Herbs Tincture Press | Retail approx. \$12/fl oz (30 mL) or greater |
| Capsules | <ul style="list-style-type: none"> Rhodiola, cut, dried, ground Empty two-piece capsules, either HPMC (VegiCaps) or gelatin Excipients (additives, as needed) Bottles | <ul style="list-style-type: none"> Washing equipment Driers, either commercial or homemade Commercial grinder Manual or mechanized encapsulation equipment Funnels / bottling equipment | Roots must be dug, coarsely chopped, washed, further chopped, and dried. Dry material is then ground to standard particle size and encapsulated in two-piece capsules either manually or mechanically. Capsules are then counted, bottled, labelled, and sealed. | <ul style="list-style-type: none"> Counterspace for chopping roots Adequate space for drying Space to house grinder | <ul style="list-style-type: none"> Root washer and dryer (see above) Grinding mill Encapsulation equipment: Approx. \$20/device (manual) Or mechanized \$10,000-175,000 (used) http://www.equipnet.com/ | Retail approx. \$15-45 for 30 capsules, depending on potency and market segment |

Target Consumers

Numerous studies in the US and in Canada have shown that the predominant consumers of natural health products including herbal supplements are white, middle-aged and elderly women, with a higher level of education, living in a food-secure household.³⁻⁸ Survey data of nearly 12,000 participants collected over 20 years showed that the most commonly reported reasons for using supplements were to improve (45%) or maintain (33%) overall health.⁹

There are distinct regulatory frameworks that apply to natural health products in Canada, the US, and the EU, so marketing products in each of these regions would require different packaging specific to the marketplace. Regulatory consultants could be contracted for guidance in this area, depending on the NG's preferred scale of marketing. Potential target consumers include:

- Tourists visiting local Nunatsiavut craft shops (for retail sale of finished product)
- Retailers of natural health supplements (for wholesale of finished product)
- Supplement manufacturers and grower's co-operatives (for wholesale of bulk material)

Operations

Nunatsiavut Roseroot operations will consist of horticultural, processing, and manufacturing components. Operations may be centralized or decentralized such that components of the enterprise occur in different communities as a joint venture (i.e. one community might specialize in agricultural production and another in post-harvest processing). The infrastructure costs of multiple sites including ease of access and transportation to and from each possible site will need to be considered.

Horticultural

Rhodiola is a multi-year crop, requiring approximately 3-5 years from transplant to harvest, depending on the methods of propagation used in planting.¹⁰ Horticultural trials have already begun in both Nain and Rigolet to determine appropriate cultivars, suitable soil types, locations, and propagation techniques for rhodiola in Labrador (Mardones, PhD research, unpublished data). Expansion of existing plots and/or establishment of new gardens located within or outside participating communities will be necessary to ensure sufficient **sustainably sourced** plant material for manufacturing. Soil testing of selected sites should be conducted to ensure there is no trace of unwanted chemical residue before final site selection.

Good Agricultural Collection Practices (GACP; [Appendix 3](#)) should inform the horticultural operations. Plant stock which has been selected for desired growth and potency attributes should be generated in a nursery prior to transplantation to the field. Stock may be generated from seed or from sustainably selected rootstock divisions.¹¹ This stock will require a minimum of one to two years to establish prior to transplanting.¹²

Transplanting would best occur in early springtime, once the ground begins to thaw. During the first season while becoming established, the plants will require regular monitoring (every week or so) and may require intermittent watering depending on environmental conditions (during hot or dry weather). Some re-planting may be necessary in the fall or the next spring if a few individuals have died. During subsequent growing seasons, the crop would require occasional monitoring (every other week or so) to ensure there has not been vandalism due to animals, etc. Watering may be necessary again during hot or dry weather.

Harvest may occur as early as fall of the third growing year.¹⁰ Harvesting can be done manually with forks and spades, or with the assistance of mechanized equipment to loosen the soil around the roots to facilitate lifting. The plants will be dug up and manually processed to separate the below ground portion from the tops. The roots will be washed either manually or using a commercial root washer, then coarsely chopped and spread out to dry using commercial grade driers. If desired, the leaves may also be dried separately for further use. Subsequent processing will depend upon the target product selected.

Several local technicians will be trained by specialists from either MUN or Montreal Botanical Garden, and employed to propagate, transplant, monitor, and maintain the crops (2-4 employees per community, depending on the scale of operations decided upon). The initial workload (springtime propagation and transplanting) will be greatest, while monitoring and maintaining the crop will require fewer labour hours. Once the crop reaches maturity, labour hours will again increase as the plants will need to be carefully dug up and lifted for further processing.

Processing

Post-harvest processing will ideally occur the day of harvest to ensure product quality, minimizing the degradation of active constituents or any microbial contamination. Depending again upon the scale of operations (and whether leaves will be processed) decided upon by the NG, processing will require 2-4 technicians for seasonal employment. The plants will be cleaned, cut, and set out to dry in driers which meet commercial specifications. Drying will take approximately 36-48 hours depending on the specifications of the driers, and will require occasional monitoring to ensure even distribution of material and safe operations of equipment. Once drying is complete, product storage prior to distribution should be in a humidity-controlled environment to maintain product purity and potency.

Manufacturing

Depending on the product option(s) selected, further processing may occur onsite (tea blends, liquid extraction, encapsulation) or in collaboration with contract manufacturers. Current good manufacturing practice (CGMP; see [Appendix 4](#)) protocols must be adhered to for product specifications, ID testing, etc. Bottling, packaging, and labelling may be done manually or mechanically. Design of packaging might engage the art skills of community members, possibly in consultation with a graphic designer. Any copy or taglines written on packaging will need to be evaluated for regulatory compliance by a specialist familiar with applicable regulations in the target market (i.e., [Nutrasource diagnostics, Inc.](#) described below).

Market Analysis and Plan

The Natural Products Industry

Market data

Herb supplement sales increased 5.5% in 2012, a trend of continuous growth that has been consistent for nine consecutive years.¹ The total trade in herbal supplements for 2012 was 5,593 million USD according to aggregated market statistics calculated by Nutrition Business Journal.¹ Sales of specific adaptogenic herbs, such as maca root (*Lepidium meyenii*) increased nearly 23% in the US mass market channel. In the US natural and health food channel maca sales increased a staggering 40% in 2012.¹ While statistics for the sales of rhodiola are not available at this time, the impressive growth in sales shown by a comparable adaptogenic root gives some indication of the growth potential for this type of herbal supplement. Further, maca is native to and primarily cultivated in South America, while rhodiola can be locally sourced in North America, thereby shortening the supply chain and increasing the potential for profitable sales. According to the American Botanical Council, much of the growth in the supplements industry is driven by the consumer who seeks supplements for energy, stress reduction, and reproductive conditions — all of which are evidence-based applications for rhodiola.¹³

Outlook and trends

Because the natural supplements industry has seen consistently robust growth in recent decades, even despite general economic downturns, this would seem to indicate that the prospective market for a sustainably grown and potency assured medicinal plant product such as Nunatsiavut Roseroot will also show steady growth. The thriving market for natural ingredients becomes evident at events such as the recent 2014 Natural Products Expo West, a forum which brings together global ingredient suppliers and buyers, where attendance grew 5% in the last year for a total of 67,000 attendees.¹⁴ Market insights shared by industry intelligence agency Penton predict an annual growth rate of 8.6 percent

in the natural channel, for a projected revenue of \$226 billion by 2018.¹⁴ Advanced market analysis is offered as well by businesses such as [SPINS](#) or the [Nutrition Business Journal](#), which deliver consumer insights (for a fee; NBJ reports range 3,295-3,595 USD), syndicated reports, as well as custom marketing consultancy, and also maintains a comprehensive product library.

The popularity of literature such as the [Rhodiola Revolution](#)¹⁵ and [Adaptogens: Herbs for Strength, Stamina, and Stress Relief](#)¹⁶ indicates relevant consumer interest in mass markets for adaptogens in general and specifically for rhodiola. Rhodiola may be used to alleviate fatigue or depression, to improve concentration, physical performance, and emotional balance, with little to no incidence of adverse effects.² Numerous pre-clinical and clinical trials published in peer-reviewed journals¹³ support the use of rhodiola for many of these popular uses, validating these applications and indicating that rhodiola's popular use is not merely a passing fad but has valid evidence-based application that will continue to develop as further scientific research on its benefits reaches consumer awareness.

Competitive edge and profitability

Buzzwords in the Natural Channel (the commonly used name for the natural health products industry) include phrases like “fair trade”, and “sustainably harvested”.¹⁷ Nunatsiavut Roseroot would “hit” on several of these targets. While there are a number of other companies selling rhodiola products in capsule or liquid extract form, they are primarily sourcing their raw materials from Eurasia, and they are often wild-harvested. Rhodiola products derived solely from cultivated North American rhodiola are not widely available. Nor is there any other rhodiola product in the market which is cultivated and processed by way of an Aboriginal community enterprise, so Nunatsiavut Roseroot would be unique to the market in several ways.

Market Strategies

Industry trade shows such as the aforementioned Natural Products Expo West are a key forum for vendors of raw materials and value-added natural products to connect with buyers and other service providers (contract manufacturers, analytical labs, consultants, etc.). Other key international trade shows include Supplside West and Vitafoods. In Canada, the [Canadian Health Food Association](#) (CHFA) hosts CHFA East, West, and Quebec. Exhibition registration is typically charged by the square foot. For more details on these tradeshow including dates and websites, see [Appendix 5](#).

Online and digital resources for cultivating market potential are increasingly valuable. Not only for industry insight, as with SPINS or Penton, but also to increase online presence and reach a larger market. For example, [Nutra ingredients](#) is a go-to online trade publication which reaches a wide segment of the natural channel, and also maintains an online database of ingredient suppliers, searchable by formulators and manufacturers within the

industry. A simple [LinkedIn](#) company profile page can be an inexpensive and effective means of promoting the product and building a business network.

Small business accelerators can offer useful resources in business development, for a fee. The newly established [Next Accelerator](#) builds upon the established industry insights accrued by its parent company [New Hope Media](#) to offer resources for natural products entrepreneurs to grow their businesses. Similarly, [Nutrasource diagnostics, Inc.](#) offers comprehensive consultancy including contract research, product testing, and regulatory consulting, for the purpose of increasing the success of natural health companies bringing products from concept to market launch.

Competitive Analysis

Competitors selling rhodiola-based products vary based upon the form of product sold and the location it is sold at. Health food stores are more likely to sell liquid extracts in addition to capsules. Mass market outlets such as grocery stores that do carry rhodiola products tend only to sell capsules, which is the most commonly sold form of rhodiola product. Rhodiola-based teas are the least common form of rhodiola seen in any retail outlet.

Example companies

The following companies sell one or more rhodiola-based products, and could be viewed either as competitors providing finished products, or potential clients for raw materials, depending on the chosen market strategy for Nunatsiavut Roseroot.

Natural Factors, based in Coquitlam, British Columbia, with Eastern offices in Mississauga, Ontario and US Sales & Distribution Center in Everett, Washington. Sells a 30 capsule bottle of 150 mg *Rhodiola rosea* extract, standardized to 3.5% rosavin. Package claims “*Support for stress and the nervous system.*” Sold at mass market and natural channel outlets in the US and Canada for a retail value of approximately \$15.95.

Alberta Rhodiola Rosea Growers Organization (ARRGO), based in Alberta, Canada is a cooperative of Alberta farmers specializing in the cultivation of *Rhodiola rosea*. ARRGO provides lifecycle support to member farmers from cultivation, production, quality assurance, and sale of raw materials and herbal products based on rhodiola. It was estimated in 2010 that at least 75 acres (30 ha) of rhodiola in various stages of growth were in production in Alberta.¹²

New Chapter, based in Brattleboro, Vermont, USA. Sells 30 capsule bottles of *Rhodiola rosea* hydroethanolic extract, both a 100 mg (= 880 mg root; min. 5 mg total rosavins and min. 1.8 mg salidroside) and a 300 mg (= 2,550 mg root; min. 15 mg total rosavins and min. 5.4 mg salidroside). Package claims “*Promotes overall mental health and stamina.*” New Chapter also sells several combination formulas which contain rhodiola (Stress Take Care, Perfect Energy, and Supercritical Diet & Energy). Sold at mass market and natural

channel outlets in the US and Canada for a retail value of approximately \$18.95(100mg) or \$37.95 (300mg).

Herb Pharm, based in Williams, Oregon, USA. Sells hydroethanolic and glycerite liquid extracts of organic *Rhodiola rosea* in 1 ounce (retail approx.\$12.50) and 4 ounce (retail approx. \$47.50) dropper bottles as well as a 60 capsule bottle (retail approx.\$17.00) containing 340 mg of extract per capsule (= 2,720 mg whole root). Package claims read “*Promotes Energy, Endurance & Stamina.*” Herb Pharm also sells a liquid combination formula containing rhodiola called Stress Manager / Adaptogen Compound. Sells primarily in the Natural Channel (i.e., health food stores) but recently expanded into mass market outlets.

Urban Moonshine, based in Burlington Vermont, USA. Sells a hydroethanolic liquid extract of organic *Rhodiola rosea* in a 2 ounce dropper bottle (retail approx. \$23.99). Also sells a rhodiola-based combination formula called Organic Energy Tonic in both a 2 ounce dropper (retail approx. \$15.50) as well as the more novel (and faster acting) 15 mL spray bottle (retail approx. \$7.99). Packaging states, “*Outdo Fatigue*Promote Vitality*Athlete Approved.*” Sells primarily in the Natural Channel (i.e. health food stores).

Company strategies/assets

The following companies utilize unique market strategies which could be applicable in the development of Nunatsiavut Roseroot.

Urban Moonshine: “Our mission is to rekindle the relationship between herbal medicine and the modern world.”

“*Handcrafted*”: Urban Moonshine emphasizes the smaller scale of their production in packaging and promotional material, an advantage which Nunatsiavut Roseroot might also share, in contrast to the industrial scale of other competitors selling rhodiola products. Urban Moonshine also has capitalized on a fairly uncommon mode of administration, the 15 mL spray bottle which has the advantage of being smaller than dropper bottles and so lends itself to point-of-purchase or impulse buys. This format is also arguably faster acting than capsule formulas or even other liquid extracts, due to the direct delivery via oral mucosa. Additionally this size packaging lends itself to convenience for the consumer; easy to carry along in purse or pocket for dosing as needed.

Clef des Champs is an organic herb and spice company based in Quebec. Marketing products which are both medicinal and culinary, Clef des Champs models a business based upon **sustainable organic** cultivation, striving to be carbon neutral, while also giving back to the community in the form of ecological initiatives. Clef de Champs manufactures liquid extracts from 200 different plant species, all of which are cultivated in their own gardens in the Laurentian Mountains of Quebec. They also offer capsules, loose teas, and culinary herbs and spices. Plants which are sourced from producers outside of North America are in many cases **fair trade** certified. They do not sell any products containing rhodiola.

Alaffia is a successful mission-driven enterprise that sells quality assured products in the natural channel. Based in Olympia, Washington, USA, in cooperation with communities in Togo, Africa, Alaffia was founded to alleviate poverty and advance gender equality in West Africa through the **sustainable fair trade** of handcrafted shea butter. Their products are intended to inform the public about interconnections between communities and how poverty can be ameliorated through fair trade and sustainable choices. Their cooperative business model and community projects encourage self-empowerment and gender equality for women in West African communities. Projects include Bicycles for Education, Maternal Health, School Supplies & Repairs, and Reforestation & Environment.

While not involved in the trade of rhodiola, Alaffia is an example of a successful sustainable fair trade enterprise which brings benefits to the communities involved. Alaffia products are certified FairTrade by the Institute for Market Ecology (IMO). Founder of IMO, Dr. Rainer Bächli, states “We build bridges between regional suppliers and discerning consumers across many languages, cultures and expectations.” Informed consumers often will choose a fair trade product when it is a viable option, knowing that they are supporting empowerment and community development through their purchase. “The major aim is not just the product and its quality alone but above all the people involved in the projects. It is important to support their work by respect and cultural understanding. Together, we are creating perspectives for a sustainable future.”

Fair trade certification is available by applying to IMO or to the Fair for Life Social & Fair Trade Certification Programme, a certification scheme that IMO utilizes for evaluating social and fair trade activities. The cost of certification will depend on the size and complexity of an operation, its location, and the scope of certifications applied for, so an exact figure cannot yet be predicted for the present enterprise. However, a sample breakdown of cost estimation for an operation in Canada is included in Appendix 6; total cost was approximately 3,400 USD (approx. 3,750 CAD).

Strategy and Implementation

Design and Development

The major milestones in designing the organizational and operational structure of Nunatsiavut Roseroot from concept to market are as follows.

1. Define mission, scope of operation, and budget
2. Establish organizational management structure
3. Select target products based on NG goals
4. Initiate horticultural operations (likely rotational cropping) with adherence to Good Agricultural Collection Practices (GACP; Appendix 3)

5. Develop the market; design packaging, select contract manufacturer, develop distribution channels
6. Harvest
7. Process
8. Manufacture with adherence to Current Good Manufacturing Practices (CGMPs; [Appendix 4](#))
9. Package (ensuring regulatory compliance)
10. Distribute

Financial Factors and Projections

Initial capital investment will be minimal, early expenses consisting mainly of the training and wages for technicians involved in horticultural operations, which may be subsidized by available federal jobs programs. Other costs associated with crop production will include the costs of seeds or seedlings, soil preparation, transplanting, weeding, fertilizer, harvesting, and root washing.¹² The land upon which the crops will be situated will likely be provided by the NG, and so will not require leasing or purchase. Equipment and soil amendments required for planting will be minimal. As further processing won't be necessary for several years, these are the only initial expenditures. It is estimated that yields per acre should be at least 2,300 lb (2,577 kg/ha) to be profitable.¹² In central Alberta, yields of approximately 5,220 lb per acre (5,850 kg/ha) have been realized in five-year-old plants.¹² For a detailed projection of agricultural production costs per acre, see [Appendix 7](#).

Once the crop nears maturity, the procurement of drying equipment and space will be necessary, and mechanical harvesting equipment may also be desired, requiring lease or purchase. Most likely the facilities for housing the driers and processing will be provided by the NG, and so will not contribute significant overhead costs. Wages and material costs (solvents for extraction, etc.) will also factor in post-harvest processing expenditures. If utilized, contract manufacturing may be the most significant expenditure at this point.

Marketing and distribution will likely be minimal if the target consumer segment is local or regional, with products to be sold in Nunatsiavut craft shops. Marketing and distribution, as well as regulatory consultations, could incur significant costs if a wider market is sought.

Funding programs offering targeted wage subsidies are available that might assist with employment costs, for example the NG's Aboriginal Skills and Employment Training Strategy (ASETS), the Labrador Aboriginal Training Partnership, or the [NL Job Creation Partnerships program](#). The National Research Council's [Natural Health Products Program](#) and the [Research and Development Corporation of Newfoundland and Labrador](#) have funding such as [R&D Vouchers](#) or [R&D Proof of Concept](#) that could help defray research

and development costs including those associated with regulatory compliance (i.e. animal testing or lab work). An [NSERC Engage](#) grant could be applicable in developing a new research and development partnership between Nunatsiavut Roseroot and an academic researcher.

This preliminary opportunity analysis highlights a variety of options, and it is anticipated that a more detailed analysis of start-up costs and projected revenue will be undertaken if the NG decides to move ahead with this project, depending upon the scale of operations, type of products, organizational structure, and the target market that the Nunatsiavut Roseroot steering committee decides upon.

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Appendices (available upon request)

1. Health Canada *Rhodiola rosea* monograph
2. Quality of Natural Health Products Guide
3. Good Collection and Agricultural Practices (GCAP)
4. Current Good Manufacturing Practices (CGMP)
5. Industry Trade Shows
6. Sample Fair Trade certification costs
7. Estimated production costs for *Rhodiola rosea* per acre